MIL-S-19500/1A
4 May 1967
SUPERSEDING
MIL-T-19500/1
14 June 1957
(See 6.2)

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, GERMANIUM, LOW-POWER

TYPE 2N220

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for a low-power, PNP, germanium transistor.

1.2 Physical dimensions. See figure 1 (TO-1).

1.3 Maximum ratings.

P_C 1/	V_{CBO}	V_{EBO}	T_{stg}
mW	Vdc	Vdc	°C
20	-30	-12	-65 to +100

1/ Derate linearly 0.444 mW/° C for $T_A > 25°$ C.

1.4 Primary electrical characteristics.

	h_{FE} V_{CE} = -4.0 Vdc I_C = -0.5 mAdc	C_{obo} V_{CB} = -4 Vdc I_E = 0.5 mAdc 1 kHz ≤ f ≤ 1 MHz	NF V_{CB} = -4 Vdc I_E = 0.5 mAdc
		pf	db
Min.	40	---	---
Max.	120	50	6

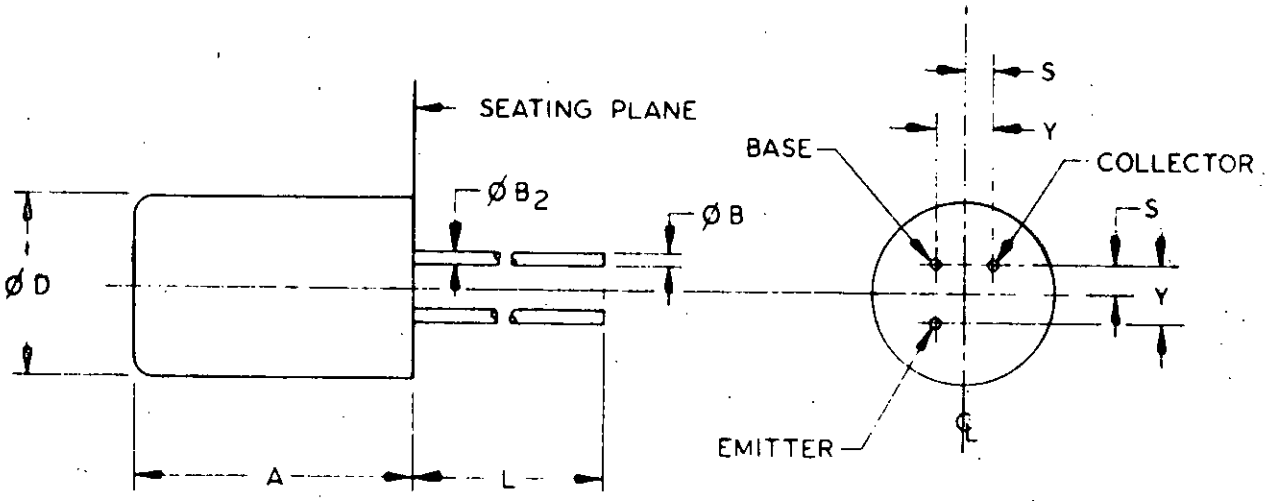
2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for.



Ltr	Inches		Millimeters		Notes
	Min	Max	Min	Max	
A	--	.410	--	10.41	
øB	--	.021	--	.53	2,4
øB2	.016	.019	.41	.48	3,4
øD	--	.240	--	6.10	
L	1.500	--	38.10	--	4
S	.0216	.0286	.55	.73	
Y	.0431	.0573	1.09	1.46	

NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. Measured in the zone beyond .250 (6.35 mm) from the seating plane.
3. Measured in the zone .050 (1.27 mm) and .250 (6.35 mm) from the seating plane.
4. All three leads.
5. All leads shall be electrically isolated from the case.

FIGURE 1. Physical dimensions of transistor type 2N220 (TO-1).

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500.

3.3 Design, construction, and physical dimensions. Transistor shall be of the design, construction, and physical dimensions shown on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I and II.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted from the body of the transistor at the option of the manufacturer:

(a) Country of origin.
(b) Manufacturer's identification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I and II.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of groups A and B inspections.

4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I and II.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			10				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			5				
Collector-to-base cutoff current	3036	Bias cond. D; V_{CB} = -30 Vdc		I_{CBO}	---	-12	μAdc
Emitter-to-base cutoff current	3061	Bias cond. D; V_{EB} = -12 Vdc		I_{EBO}	---	-12	μAdc
Subgroup 3			10				
Small-signal short-circuit forward-current transfer ratio	3206	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{fe}	40	120	---
Open-circuit output capacitance	3236	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc 100 kHz ≤ f ≤ 1 MHz		C_{obo}	---	50	pf
Noise figure	3246	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc Rg = 1,000 ohms R_L = 20,000 ohms f = 1 kHz		NF	---	6	db
Small-signal short-circuit input impedance	3201	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{ib}	---	65	ohms
Small-signal short-circuit output admittance	3231	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{ob}	---	0.8	μmhos
Small-signal open-circuit reverse voltage transfer ratio	3211	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{rb}	1.3	15	$x10^{-4}$

TABLE II. Group B inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			20				
Physical dimensions	2066	(See figure 1)		---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 2			15				
Solderability	2026	Omit aging		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. B, except T(high) = 100 $^{+3}_{-0}$ °C		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Seal (leak-rate)	---	Method 112 of MIL-STD-202; test cond. C, procedure III; test cond. B for gross leaks		---	---	5×10^{-7}	atm cc/sec
Moisture resistance	1021			---	---	---	---
End points:							
Collector-to-base cutoff current	3036	Bias cond. D; V_{CB} = -30 Vdc		I_{CBO}	---	-12	μAdc
Small-signal short-circuit forward-current transfer ratio	3206	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{fe}	40	120	---
Noise figure	3246	V_{CB} = -4 Vdc I_E = 0.5 mAdc Rg = 1,000 ohms R_L = 20,000 ohms, f = 1 kHz		NF	---	6	db
Subgroup 3			15				
Shock	2016	Nonoperating; 1,500 G approx. 0.5 msec, 5 blows in each orientation: X_1, Y_1, Y_2, and Z_1		---	---	---	---
Vibration fatigue	2046	Nonoperating		---	---	---	---
Vibration, variable frequency	2056			---	---	---	---
Constant acceleration	2006	20,000 G; in each orientation: X_1, Y_1, Y_2, and Z_1		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 4			20				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 5			20				
Salt atmosphere (corrosion)	1041			---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 6			λ = 10				
High-temperature life (nonoperating)	1031	T_{stg} = 100° C		---	---	---	---
End points:							
Collector-to-base cutoff current	3036	Bias cond. D; V_{CB} = -30 Vdc		I_{CBO}	---	-14	μAdc
Small-signal short-circuit forward-current transfer ratio	3206	V_{CB} = -4.0 Vdc I_E = 0.5 mAdc		h_{fe}	32	140	---
Noise figure	3246	V_{CB} = -4 Vdc I_E = 0.5 mAdc Rg = 1,000 ohms R_L = 20,000 ohms f = 1 kHz		NF	---	7	db
Subgroup 7			λ = 10				
Steady-state operation life	1026	P_C = 20 mW min. V_{CB} = -12 Vdc		---	---	---	---
End points: (Same as subgroup 6)							

5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500, section 5.

6. NOTES

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:
Army - EL
Navy - SH
Air Force - 11

Preparing activity:
Navy - SH

(Project 5961-0002-11)

Review activities:
Army - EL, MU, MI
Navy - SH
Air Force - 11, 17, 85

Code "C"

User activities:
Army - SM
Navy - CG, MC, AS, OS
Air Force - 14, 19